POLICY RESEARCH WORKING PAPER 1466

Ownership and Financing of Infrastructure

Historical Perspectives

Charles D. Jacobson
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History provides many examples of movements both toward and away from private ownership and operation of infrastructure. In France, Great Britain, and the United States, shifts between local, intermediate, and national levels of government in ownership and regulation of some forms of infrastructure have also been common. And spending cycles in all three countries have been marked by bursts of spending followed by periods of retrenchment and stability.

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Summary findings

Jacobson and Tarr summarize the rich and varied experiences of private and public provision of urban services in France, Great Britain, and the United States over the past 100 years. Their main focus is on experiences in the United States and on shifts back and forth between the public and private sectors. A few of their observations:

- The values of politically important actors as well as the working of government, political, and legal institutions have shaped decisions about infrastructure development, the sorts of public goods demanded, and the roles played by private firms.
- The range of choices that has historically been made with respect to the ownership, financing, and operation of different infrastructures has been far too varied to be encompassed by simple distinctions between "public" and "private."
- Throughout the world, many infrastructures owned and operated by governments have been built by private firms.
- In the United States, private firms and property-owners associations of various sorts have owned outright both toll roads and residential streets. Private firms have also collected solid wastes and provided urban transport under a range of franchise, contracting, and regulatory arrangements. The situation with mass transit has been similar in Great Britain. Although water works facilities in France are predominantly government-owned, private firms operate and manage most systems under an array of contracting and leasing arrangements.
- Even when facilities have been owned by private firms, direct competition has been of limited importance in the provision of many kinds of infrastructure. But market discipline can arise from other sources.
- Privatization can get government bureaucracies out of the business of performing entrepreneurial activities for which they may be poorly suited. When market forces are weak, however, and important public interests are at stake, strengthening government institutions may be a prerequisite for successful privatization.
- In the electric utility industry, private firms played a far greater role in U.S. electric utilities than in Great Britain, in part because of different views about appropriate roles for government in providing essential services. For similar reasons, the state played a much larger role in furnishing telecommunications services in France than in the United States.
- Beliefs about the "publicness" of different goods and services have helped shape the character of regulatory, franchise, and contracting arrangements. When a good is seen as mainly private, it is easier for private service providers to be compensated mainly by user fees and for most decisions about price, output, and quality of service to be left to them. But for goods viewed as public and subsidized by taxes, government agencies make many decisions about price, output, and quality, no matter what the role played by private firms in actually providing services.
- Goods defined as "public" have often been provided free to users, even though it would have been easy to exclude nonpayers. Examples in the United States include interstate highway systems, public parks, public libraries, and police and fire protection. Free services have been provided because it is believed that in these domains market relationships should not apply — and that denying nonpayers the public service would be a denial of rights.
- In Great Britain and the United States, the contracting out of public services has been both supported and opposed because of its potential to break the power of public sector unions and to cut workers' pay. In the United States, privatization has also come under attack on the grounds that opportunities for minority employment may be reduced.

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Ownership and Financing of Infrastructure: Historical Perspectives

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A background paper for the *1994 World Development Report*

Note: This paper was originally called *Public or Private? Some Notes from the History of Infrastructure*

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Introduction

In physical terms, infrastructure can be viewed as the structures and networks that frame and bind together modern cities and metropolitan areas and make it possible to undertake social and economic activity. It is the streets and the highways, the waste disposal systems, the water and sewer lines, the electric and gas supply and distribution facilities, and the telecommunication networks (Tarr 1984b:1). In the language of economics, such facilities manifest both public goods and natural monopoly attributes. Positive economic spillovers can be large and good-quality services can provide diffuse public benefits and raise property values (Aschauer 1991:21-68), even thought ongoing competition.undercuts the need for expensive duplicate capital facilities. Public buildings and parks and recreation areas can also be viewed as infrastructure, as can such labor-intensive services as solid waste disposal, police, fire, and emergency services, which underpin the quality of urban life and are generally considered a public, or governmental, responsibility.

This essay will focus primarily on the complex and varied history of infrastructure and service delivery in the United States. For purposes of comparison, however, there will be some discussion of experiences in Great Britain and France. As shall be seen, the history of infrastructure in these countries has been quite different from that in the United States, despite many similarities. Even a cursory overview of the history of infrastructure in all three countries makes it clear that there has been enormous variation over time with respect to:

- The public and private provision of services: History provides many examples of movement toward privatization and vice versa.

- Levels of government furnishing or overseeing infrastructure provision. In the United States, Great Britain, and France, shifts between city, state, and federal activity in the ownership and regulation of some forms of infrastructure have been quite common.

- Spending and investment patterns: Spending cycles in all three countries are marked by bursts of spending followed by periods of retrenchment and stability.

While this essay focuses primarily on the shifts between public and private service provision, it is impossible to separate this theme from the other two. Nor does a simple distinction between "public" and "private" really encompass the range of arrangements that has existed with respect to the ownership, financing, and the operation of facilities.

At any given time over the last century or so, one could have found the following mix of arrangements with respect to nominally government owned facilities in the United States:

Funding Arrangements:

Funded by user fees.

Free to users, funded by tax assessments.

Free to users, funded by assessments on abutting property holders.

A combination of any of the above.

Operating Arrangements:

Government agencies build and operate facility.

Some or all of construction of facility contracted out to private firm.

Some or all of operation of facility contracted out to private firm.

With regard to financing privately owned infrastructure, similar variation can be found, combining some measure of user fees and of subsidies drawn from tax assessments.

In the United States, the main methods employed for facilities operation have been franchise contracts (usually by municipalities) and ongoing forms of regulation over price and service terms, with the primary activity taking place at the state and federal levels of government

Ownership and infrastructure in the United States

Forms of infrastructure ownership, financing, and government involvement have varied enormously in the United States at different places and times. This variation has arisen in the context of a complex federal political system with numerous partially independent decisionmaking authorities. Although the size and relative importance of the federal government has greatly increased since the 1930s, a large proportion of policymaking concerning infrastructures continues to take place at local and state levels. The presence of multiple centers of authority has made experimentation possible, despite the system's inability to change rapidly. Because of divisions of authority amongst executives, legislatures, and courts and among levels of government, wide-ranging reforms of any sort with respect to the ownership and governance of infrastructure have been less common in the United States than in other countries.

Two sets of broad and at times conflicting ideas have played the greatest role in shaping decisions to construct infrastructures and networked systems in the United States and in determining their ownership and regulatory status. The first of these ideas—and probably the most important overall—has been the widely held belief that development of networked systems should be pursued in such a way as to maximize overall economic development and individual economic opportunity. From the very beginnings of the nineteenth century to the present day, networked systems and forms of infrastructure ranging from traditional waterworks, turnpikes, and railroads to proposed national "data highway" have been conceived as economic development tools. At the same time, broad fears of irresponsible accumulations of either political or economic power have also shaped public policies toward infrastructures. In the United States, with some interesting exceptions, such fears have led to the development of private approaches for infrastructure management. Private ownership (even of a monopoly) has been justified as both more consistent with values of individual initiative than is government provision and as a counter-balance to political excesses.

American federalism also pushes in the same direction. When compared to the scale of electric utility, telephones, and even some waterworks systems, municipalities (and even some states) are relatively small. Local and state jurisdictions have therefore competed strongly for infrastructure projects, with local and state governments implementing policies to encourage (and even subsidize) the construction of infrastructure and reduce the cost to private firms involved. Privately owned service providers, furthermore, have often been able to gain relief from governmental decisions unfavorable to them by exploiting divisions of political authority between local, state, and federal levels of government or by turning to the state or federal judiciary (Scheiber 1975). Government and mixed approaches for the provision of infrastructures have been implemented only where private provision seemed impracticable or inadequate.

Infrastructure services in U.S. cities

Roads and streets

Roads and streets are perhaps the oldest of all forms of infrastructure and continue to play vital roles in the circulation of people and commerce among and within centers of habitation. Virtually all of the funding and ownership arrangements listed above have been applied at one time or another to roads and streets in the United States. Although pragmatic and decentralized decisionmaking has made for the use of a wide variety of expedients in different circumstances, some broad patterns can be discerned. Interestingly, consistency is greater with respect to financing than with respect to ownership. Within cities and inhabited places, financing for streets (whether publicly or privately owned) has been most widely and regularly obtained from assessments on property or from general tax revenues. Except for charges for the parking of cars, user fees are virtually unknown. For routes outside of densely populated areas, user fees in the form of tolls have been more common at various times, but here, too, support through assessments on property (or more recently fuel taxes and general tax revenues) have always been far more common.

With respect to routes outside of cities, the heyday of privately owned and operated roads supported by user fees came during the early decades of the nineteenth century. Many roads were built and maintained by state-chartered turnpike companies. Details of the charters and franchises varied, but in general, both tolls and broadly defined standards of construction and maintenance were specified. Particularly in the less-populated western areas of the country, such turnpikes served a developmental function, with benefits accruing not only to users of the facility but also to landholders in entire regions, whose property values were raised by the improved access. In some instances, states issued private turnpike companies land grants so they could capture a portion of this gain and thus be recompensed for high capital costs during the early years, when traffic volumes and revenues from tolls were meager. But unlike local and state governments, companies could not legally obtain ongoing recompense from rising property values through the assessment of tax levies. Partly as a result of this handicap and partly as a result of competition from canals and railroads by the 1860s, most private toll roads had been turned over to states and counties for operation from general tax revenues (Bruchey 1965:124-40).

Use of toll charges to underwrite the provision of major limited-access roads outside of urban areas experienced a resurgence during the 1930s and 1940s. A major institutional

arrangement employed was the public authority. Like the turnpike companies of the nineteenth century, such authorities are chartered by the state and deputed such governmental powers as the right to condemn land. But unlike them, ownership generally remained entirely in state hands, with private investors involved as holders of debt securities (but amortized from toll revenues rather than equity). Examples of such roads built during this period include the Pennsylvania, Ohio, New Jersey, and Massachusetts turnpikes and the New York State Thruway. By 1973, there were 4,100 miles of toll road in the United States. Most limited-access highways in the nation and virtually all other major roads, however, are not only government owned but free to users. Major sources of revenue include earmarked fuel-tax revenues and road-use fees for trucks and busses, usually assessed on a flat, yearly basis. Private firms have been involved primarily not as owners of facilities but as operators of food and fuel concessions at turnpike rest areas and as engineering and construction contractors (Keating 1989:86-8).

As noted, patterns within cities have differed from those outside. With user fees and tolls virtually unknown, a wide variety of private, public, and mixed development strategies have been employed in the United States so as to draw upon increased property values to finance the construction and maintenance of streets and thoroughfares. At times, choices have been contentious due to the substantial financial stakes and questions of access and privacy involved. In nineteenth-century American cities, politicians were sensitive to the manner in which decisions concerning streets could win them support from influential businessmen, citizens, and neighborhood groups as well as provide them with opportunities for patronage and kickbacks. City councils usually responded quickly to requests for street openings or improvements that were commerce serving and furthered the prosperity of businesses in major commercial sections. General tax revenues were often used for this purpose as well as assessments on abutters, and ownership was almost always secured in public hands.

Residential neighborhoods were a different story. One widely employed approach was for the municipality to undertake improvements only upon the petition of a certain proportion of abutting property holders. When the petitions were granted, the city would collect special assessments from all abutters. In many cases, however, assessments were not fully paid and costs had to be covered from the general tax fund or the improvement was terminated.

From the late nineteenth century onward, the private sector became more directly involved. In many cities, real estate developers laid out and constructed some streets, recouping costs through the sale of lots. Typically, the streets would then be deeded over to a municipal government to be maintained out of general revenues—most of which were themselves obtained through property tax assessments (Weiss 1987:40-1). In some instances, however, developers turned over streets and other infrastructure not to municipal governments but to private home owner associations empowered to assess fees on members for upkeep and maintenance.

An example of a case where streets remained private is in the St. Louis metropolitan area, where a number of privately owned and maintained residential streets (these were ninety private-street subdivisions during the high point of such development) have existed as self-governing enclaves since the mid-nineteenth century. The rationale for the high number of private streets in Saint Louis appears to have rested on the desire for land-use restrictions and infrastructure superior to that offered by the municipality (In 1880, St. Louis ranked eighth in per capita

expenditures among the nation's ten largest cities; in 1890 it ranked ninth). As one historian writes, "Necessity demanded a heavy reliance on private enterprise to fill the gap," (Beito and Smith 1992:270-71). In the face of inadequate municipal infrastructure supply, developers installed their own streets, water supplies, and sewers, often expecting to sell them to the city. The offering of package deals of houses and infrastructure (known as "tied-sales") by nineteenth and twentieth century developers was a common phenomenon in new subdivisions in city and in suburb.

While most residential streets in the United States continue to remain in public hands, the cases in which private developers choose not to deed streets over to municipalities are increasingly common. Here too, however, it is generally property holders rather than users who have borne the costs of both construction and operation. In general this has been accomplished by means of developers deeding ownership of streets and other common areas to property owners association of various sorts, which, in turn, are given the right to assess yearly charges. In both law and practice, the line between such property owner associations (generally considered private) and municipal corporations (generally considered public, but with quite similar powers to assess and to regulate) has been quite thin, with one form sometimes blending into the other.

One of the most vital phases of homeowner development is associated with the rise of large-scale real estate developers or "community builders". Community builders formed community associations in order to enforce and adapt deed restrictions; to develop and maintain common areas, open-space and privately-owned infrastructure; and to provide services to residents (Weiss and Watts 1989:2). While private residential subdivisions appeared as early as the 1830s, the major shift towards large-scale suburban subdivisions came after the 1920s. In this phase, subdividers became full-fledged suburban housing developers, providing lots, houses, parks, schools, shopping centers, and other community facilities. In the process, they also assumed, as Marc Weiss and John Watts note, the "function of being private planners for American cities and towns," providing "private innovation preceding public action." This process also applied to the supplying of important community services and infrastructure, sometimes turned over to local government and at other times continued under private control (Weiss and Watts 1989:6-7).

Homeowner associations were increasingly viewed as essential to residential subdivision development. In the 1930s the policies of the newly created Federal Housing Administration (FHA) favored subdivisions inhabited by residents with similar socioeconomic features, comprehensive deed restrictions, design controls, and the use of common park and playground facilities. With the coming of the condominium and the planned unit development (PUDS) in the 1960s, community associations greatly increased, soaring from under 500 in 1962 to over 15,000 in 1973. Driving their creation was the requirement of both condominiums and PUDS for a community association to maintain common areas. The purpose of community development associations now shifted towards maintaining common property and providing services rather than enforcing deed restrictions (Weiss and Watts 1989:18). During the 1960s and 1970s, community associations continued to grow in number, increasing from 25,000 in 1975 to over 90,000 ten years later (50,000 were condominium associations), but these new associations usually involved a much smaller number of residential units. Increasingly, common property is set up to reduce costs rather than to bring about a maintenance-free lifestyle.

In addition, developers forming associations began to respond more to local government regulations rather than to home-buyer preferences (Weiss and Watts 1989:21). In some cases, localities have refused to accept common areas and private streets within private developments. In other situations, however, developers have found that—by retaining control of a range of infrastructure items such as streets, sewers, and utility lines—they can reduce their costs below what they would be if they constructed them according to public standards. Thus developers create the community associations to own and maintain private facilities in order to lower initial costs, although maintenance and repair charges may be much higher in the long run. One check on this practice is the FHA, VA, Federal National Mortgage Association (Fannie Mae), and Federal Home Loan Mortgage Association (Fannie Mac) requirement for properly organized community associations to purchase mortgage loans.

Another development since World War II has been a proliferation of privately owned streets and common areas in commercial districts. Before World War II, privately owned streets in commercial districts were extremely uncommon. Over the last forty years, however, private ownership and operation of entire commercial districts (in the form of shopping malls) has become ubiquitous. The entire property usually remains in the hands of one holder, with costs of maintaining common areas, streets, and parking lots recompensed as part of the rental fees paid by retail tenants. As parking is usually free to customers, the result interestingly enough is that infrastructure provision relies less, rather than more, on user fees than public streets with parking meters.

Political and social factors may account for the continued growth of private associations. Private ownership of common areas in shopping malls, as well as of residential streets, makes it possible to control access and to exclude people or activities regarded as undesirable. A number of court decisions over the last half-century have resulted in greater protection for such activities as circulating petitions, picketing and holding political demonstrations, and begging for money on public streets and in public gathering places. Such control has been an important (if difficult to quantify incentive) for privatization, and issues of the character of public and political life and of civil rights—as well as of efficient service provision—are raised by the increasing turn to private streets.

Public transportation and transit

Few areas of infrastructure provision in the United States have undergone the massive shifts of ownership and operation that characterized the public transportation sector, and especially urban transit. Public involvement in the supply of transportation facilities has had a long history in this nation. In the first third of the nineteenth century, for instance, state governments were especially active in providing capital for such transportation infrastructure as canals, bridges, toll roads, and railroads. These projects were either under state control or were mixed enterprises, combining public and private construction and operation. The motives for these policies included promotional goals (social overhead capital), a desire for public profit, concern over the limitations of private corporations, and the provision of employment. These state public works projects reached a peak in the 1820s and 1830s, with sharp reductions in spending after the depressions of 1837 and 1857 due to over-investment, high taxes and corruption. Thousands of miles of state-built canal systems were abandoned, other rights-of-way

were turned over to private enterprise. In a few cases state ownership continued. At the same time, however, a number of cities (such as Pittsburgh and Cincinnati) concerned about being bypassed by private railroads being constructed, invested in railroad bonds in order to insure access. In many cases, such investments turned out to be worthless (Tarr 1984b:7-9).

The era of major private construction and operation of municipal transit lines (as opposed to intercity and regional connections) began in the 1850s and extended up through the post-World War II period. Private entrepreneurs and land speculators constructed many thousands of miles of transit in large and small cities, operating under various forms of municipal charters and franchises. They hoped to benefit from both fare revenue and from land speculation in areas served by their lines. Public transit became steadily more capital intensive from 1850 to 1900, shifting from horse-car lines to cable, and then to electric traction, but almost always remaining private.

As cities grew more congested, however, and existing transit lines were unable to handle increasing travel needs, demands rose for the construction of capital-intensive subway and rapid transit lines. In major cities, private entrepreneurs were reluctant to assume the risk involved in the large investments, and strict private ownership and operation become less common. In Boston, New York, and Philadelphia, for instance, public transit commissions staffed by both private and public representatives planned and built high speed lines financed and owned by the city. The lines, however, were leased to private operators and the commissions retained regulatory rights (Cheape 1980:100-1, 152-3, 206-7).

Beginning about 1910, however, transit lines in this country began to experience more and more financial strain. The rise of the automobile as a competing form of transportation played an important role but was only one of the reasons for their fiscal difficulties. Factors such as overbuilding and heavy construction and maintenence costs were just as critical. Many lines were constructed with the expectation of reaping windfall profits in real estate appreciation, and the failure of these to materialize strained company finances. In addition, the obligations transit lines operated under in regard to street maintenance and fare restrictions and free transfer requirements increased their fiscal burden (Cheape 1980:215-16).

In response to these problems, transit firms attempted to create a transit monopoly by trading long term franchises for fare restrictions, meaning that the industry found itself in financial trouble in inflationary periods. Monopoly was not enough to guarantee survival, and transit companies in cities such as Philadelphia and Boston, for instance, went into receivership by World War I. According to one source, about one-third of the transit industry was in bankruptcy by 1918. In some cases, such as Boston in 1918 and 1919, the two most important transit lines in the state were put into the hands of public trustees who raised fares in an attempt to cover expenses and who also authorized municipal subsidies for their operation.(Wohl 1982). More customary, however, was streetcar company disinvestment in equipment and trackage.

Beginning in the 1920s, as the cost of the automobile declined and ownership spread, public transit lines began to lose ridership and to suffer further financial damage. Between 1940 and 1979, the net operating revenues for the transit industry dropped from a profit of $96 million

to a deficit of $2,380 million (Wohl 1985). Increasingly, the supply of transit became a responsibility of public authorities rather than the private market.

Municipally funded and owned subway systems first appeared in Boston in 1897, followed in 1904 and 1932 in New York City, although in each case the lines were constructed and operated by private companies. Almost all electric streetcar lines, bus lines, and elevated lines (with the exception of those in San Francisco, Seattle, and Detroit), remained private until a shift to public ownership began in the late 1940s. By 1948, although only 36 out of 1,400 transit properties were publicly owned and operated, they were located in large cities such as Boston, Chicago, Cleveland, New York and San Francisco, and represented about one-quarter of the industry's operating revenues. The shift continued in the 1950s and the 1960s, with private ownership declining from about 64 percent of urban transit systems in 1960 (cities over 50,000) to just over 50 percent in 1978, although the publicly owned systems represented about 90 percent of the industry's patrons and operating revenues (CBO,1988).

In 1964, Congress created the Urban Mass Transportation Administration and the federal government became a major actor in the game of transit provision. Reflecting concern over the loss of transit service in the urban core, the legislation authorized grants to modernize transit systems in order to prevent their abandonment and to also reestablish them in the 105 cities that had lost transit service between the mid-1950s and the mid-1960s. Initially, federal funds were intended primarily for purposes of preservation and renewal, but after 1971 federal aid was available for new transit (Meyer and Gomez-Ibanez, 1981: 37-51). Federal formula grants for mass transit became available in 1974, and in 1982 a mass transit account was created in the Highway Trust Fund. In spite of this infusion of funds, the number of transit riders nationally has continued to decline as automobile usage increases for all types of trips (CBO,1988: 31-3).

During the last decade, although publicly owned and subsidized transit systems continue to dominate the field of urban transit, there have been several attempts at forms of privatization, primarily in the area of bus services. A few private, unsubsidized firms operate in market niches but the most common form of private involvement is contracting by governmental units with private companies to provide drivers or special services. Under President Reagan, attempts were made to spur privatization, and in 1984 the Federal Transit Administration issued a regulation requiring public transit authorities receiving federal aid to advance privatization in various ways. While contracting out for transportation services has increased somewhat, it still accounts for only a small proportion of total operations and is customarily limited to specialized and supplementary services (Gomez-Ibanez and Meyer, 1992: 5-1-7).

Waterworks

Since the middle of the nineteenth century, urban growth and the construction and elaboration of networked systems of water supply and distribution have gone together in the United States. As the numbers of people living in cities increased, wells, cisterns, and other alternate sources of water often proved vulnerable to contamination or simply too limited in capacity to meet growing wants. Popularization of new uses for water (such as the flush toilet) increased the demand. Waterworks also came to play increasingly vital roles in protecting urbanites against water-borne disease and their property against fire as cities increased in size. By

the end of the nineteenth century, the availability of clean, low-cost, and abundant supplies of piped-in water had come to be widely seen as a necessity of urban life in cities throughout the United States.

Initially, privately owned and operated systems predominated. In 1800, private firms owned fifteen out of the sixteen waterworks that had thus far been constructed to serve the few and small cities of predominantly rural United States. During the years that followed, many newly settled communities granted franchises to private waterworks firms. But as their populations increased and their areas expanded, major cities in the United States consistently turned to direct government provision. The only breaks in this trend came during periods like that following the panic of 1873, when state-imposed restrictions on municipal authority coincided with a continued demand for water services (Anderson 1980:104-6). Overall, the proportion of government owned waterworks in the United States increased from about 6 percent in 1800 to about 53 percent in 1896. The trend was most pronounced in rapidly growing urban centers. By 1896, only nine of the largest fifty cities in the United States still relied upon privately owned waterworks. By 1900, all but one of the eleven cities in the United States with a population of more than 300,000 had acquired or constructed a municipally owned waterworks.

Selection processes for private waterworks firms, details of the contractual or regulatory regimes under which they operated, and the scale and duration of private waterworks development differed substantially from case to case, as did the exact circumstances in which individual cities turned to municipal ownership. But certain consistent themes can be discerned. As would be expected (given the natural monopoly attributes of water-supply and distribution facilities), competition between operating waterworks firms seldom occurred, even in cases in which there were no legal barriers to entry. In a few cities, a degree of competition for franchises to build and operate waterworks facilities did occur at the outset, but since substantial investments in fixed facilities (such as water mains) were required, contracts were typically of long—or even indefinite—duration and recurrent bidding almost never took place.

In small communities in which population growth was modest, privately owned service providers and municipal governments sometimes managed to forge viable long-term relationships even in the absence of ongoing competition for franchises and contracts. In the larger cities, however, as development accelerated and population increased, existing physical facilities became obsolete and privately owned service providers and municipal governments frequently clashed over questions of new investments and issues of service quality.

In regard to the critical area of the provision of water for fire protection, the intractability of the problems under private ownership can be attributed in great part to difficulties in measuring output and monitoring quality. The "output," or amount of fire protection, actually being furnished by a waterworks depended on a combination of system attributes (including the size and layout of the water mains, the capacity and condition of pumps, and the provisions made for reservoir storage). In the early decades of the twentieth century, accurately predicting the actual performance of a waterworks in the event of a major conflagration required careful physical inspection and the exercise of considerable expertise and judgment by highly trained engineers, who had only an incomplete knowledge base to draw upon (APWA 1925:725-47). Even when problems were identified, lack of an easily observed and objectively measured standard of

performance made it difficult for a municipality to impose sanctions on an errant waterworks firm in an incremental and ongoing way.

Urban growth compounded the difficulties. Neither municipalities nor waterworks firms during the nineteenth and early twentieth centuries knew of a simple unit of output that could be easily specified in a contract and used as a basis for proportionally compensating waterworks firms for making the investments required to serve growing needs. Instead, parties with directly opposing interests had to come to terms repeatedly over issues of waterworks design and quality of service, as well as price, in order for privately owned service providers to be compensated for investments in improvements.

Such commonly employed recourses as paying waterworks firms for each fire hydrant did not obviate the need for such case-by-case negotiation and may have even worsened the difficulties involved. The problem was that the number of fire hydrants contracted for by a city bore little more than a coincidental relationship to the amount of fire protection actually received. As a consequence, hydrant-based payment formulas provided little incentive for improvements in fire protection no matter how generous the level of compensation set. A water company, for example, that replaced a system of four-inch water mains serving 400 hydrants (fed by unreliable pumping stations) with a system of twelve-inch mains serving the same number of hydrants (fed more reliably by gravity from high altitude reservoirs) would have received no additional compensation for these investments under a per-hydrant payment formula and would therefore have had no incentive for making such an investment.

As a result, even if a municipality and a privately owned water company did manage to negotiate a mutually acceptable price per hydrant and both sides sought to behave honorably in living up to contract terms, conflicts could still easily arise. A municipality, for example, might complain of inadequate investment in new facilities as the demand for water for fire protection increased, even as a privately owned water company expressed dissatisfaction at inadequate compensation for those system improvements it did make. Both of the parties involved in such a conflict, however, could reasonably believe themselves to be in the right (Wilcox 1915:23).

In the case of government-owned waterworks, by contrast, public officials could arrange for construction of facilities serving specifically public and developmental needs without the sort of difficult bargaining between parties with directly opposing interests required with private ownership. In addition, financing could easily be drawn from property tax revenues as well as from user fees—a recourse that made economic sense because of the ways in which improvements in water supply and distribution facilities contributed to increased property values and the provision of other public benefits, even for those who consumed relatively little water. Although the exact arrangements vary from place to place, cities in the United States have typically funded their waterworks through a combination of user fees, assessments on abutting propertyholders for water-main extensions, and general tax revenues.

Despite these advantages, by almost any measure, government-owned waterworks did not always perform perfectly. Numerous cases can be enumerated in which government as well as privately owned waterworks scanted on investments in facilities needed to reduce the risk of fire or protect the public health. Ignorance and uncertainty took their toll—as did institutional and

bureaucratic infighting and simple incompetence. Overall, however, government-owned waterworks in rapidly growing cities in the United States typically invested far more aggressively in water supply and distribution facilities than had their privately owned counterparts.

Economists, particularly over the last thirty years, have criticized the eagerness on the part of municipalities and other governmental entities to invest in large-scale water supply facilities on efficiency grounds. In particular, they have criticized as highly unrealistic assumptions that demand for water is insensitive to price and that supplies of water must keep pace with population and economic growth if a crisis is to be avoided. The result of rigid adherence to these assumptions, these economists complain, is inefficiency and waste as water supply facilities are constructed at a marginal cost far in excess of any marginal benefits (Hirshleifer, De Haven, and Milliman, 1960:347).

But despite these new conflicts, patterns of waterworks development established during the nineteenth century have continued to the present day. As in the past, government owned systems continue to supply water to most of the urban and suburban areas in which the bulk of America's people live. As of 1989, about three-quarters of the people in the United States served by waterworks obtained their supplies from government-owned systems. The main changes inspired by environmental and economic concerns have been with respect to the pricing of water. Metering of water has increased, markets for bulk supplies are being established in water-short regions such as California, and efforts are under way in a variety of locales to reduce subsidies and bring prices more in line with marginal costs.

Privately owned waterworks have not completely disappeared from the American scene. As of 1977, about 44 percent of American waterworks were owned by private firms. Twelve years later, 58 percent of the nation's 59,621 water systems were owned and operated by private firms. Several of these systems are quite large and serve heavily populated areas. Examples include the Elizabethtown and Hackensack water companies in suburban New Jersey. Large, privately owned systems are most common in heavily populated suburban areas carved up into small political jurisdictions, for which individual waterworks would be impracticable. They represent a vehicle for regional service delivery. Most of the thousands of privately owned systems now operating in the United States, however, are quite diminutive, serving small municipalities, unincorporated patches of metropolitan areas, or even single real estate developments. Approximately 60,000 of America's community water systems, for instance serve less than 2.7 percent of the population. In addition, about 40 million people draw their drinking water from private wells (OTA, 1987:157-8).

As in the past, government-owned systems continue to supply water to the urban and suburban areas in which the bulk of America's people live. As of 1989, about 71 percent of the people in the United States served by waterworks obtained their supplies from 26,000 publicly owned systems. A few very large community water operations (0.5 percent of the total) served more than 43 percent of the population (OTA 1991:138-39). In contrast, about 13 percent of the population drew their water supplies from 16,000 privately owned utilities (National Foundation on Public Works Improvements, February 1988:54).

Sewerage systems and waste water treatment

Like the waterworks with which they are often associated, systems of piped sewerage in the United States have typically been funded by a combination of user fees, assessments on abutting property holders, and general tax revenues. To an even greater extent than in waterworks, flat fees and assessments remain common and metering of flows, at least from small customers, is virtually unknown. Unlike the case for waterworks, privately owned centralized systems of piped sewerage have never been common in the United States. Where such arrangements have been employed, it has usually been in "company towns" (such as Pullman Illinois during the late nineteenth century or Vandergrift, Pennsylvania), in which most or all of the land and structures are owned by an individual propertyholder.

Disposal of waste water and sewage in the United States has not always been a government responsibility. Where centralized sewerage systems have not been in place, an array of arrangements for the provision of service have been found. Originally, human wastes, used water, and solid wastes in most American urban centers were disposed of privately and locally in cesspools, privy vaults, or even in street gutters. Some public and private underground sewers existed in larger cities such as New York, Baltimore and Boston, but these were intended for stormwater drainage from streets rather than for human waste removal. By the 1820s and 1830s, most large cities had instituted periodic vault emptying by private scavengers under city contract or by city employees. In many cases, cities see-sawed between the use of municipal employees and private contractors with satisfaction proving elusive under either arrangement (Tarr, 1984a:228-39).

Problems arose in considerable part because of inadequacies in cesspool and privy vault arrangements themselves as cities grew in size and density. The adoption of urban water systems increased the stress on the cesspool and privy-vault system. Different options were tried to solve the problem but eventually most major cities adopted the so-called water carriage, or sewerage, system (Tarr et. al. 1984a). Construction of municipal sewerage systems during the middle and later years of the nineteenth century was linked to a more general movement away from a piecemeal, decentralized approach to city building. The goal was a technical system that was sanitary and self-activating. Where private systems serving single streets or groups of houses existed, they were generally integrated into the municipal system to prevent pollution or eliminated entirely (Peterson 1979:94-6).

During the twentieth century, centralized sewerage systems have come to play an increased role in many suburban as well as urban areas, although septic tanks and cesspools are still employed in some suburban locales. In general, construction of sewerage systems can be seen as a success in that they removed sanitary nuisances and health threats from urban areas. Pollution was not eliminated, however, but was merely sent somewhere else (Tarr 1984a:236-39). By the first and second decades of the twentieth century, much technical knowledge existed as to how to reduce pollution impacts, and some sewage treatment plants were actually built. But investment was limited and enormous volumes of raw or minimally treated wastes were dumped into the country's streams and rivers.

The last three decades in the United States have seen the emergence of a national effort to tackle the problem. Federal and state water pollution standards have been tightened. Equally (if not more) importantly, under the terms of the Water Pollution Control Act Amendments of 1972,

the federal government began to provide municipalities with 75 percent of the money needed to plan and build waste treatment plants. From 1972 through 1984, more than $40 billion was spent by the federal government on the program with about 17,000 grants being made (Helman and Johnson 1992:36). From 1976 through 1986, the proportion of the population of the United States served by waste water treatment facilities increased from about 67 to 75 percent (Helman and Johnson 1992:41). During the 1980s, however, concern that some projects have been overbuilt and "gold-plated" and the belief that waste water treatment was primarily a local and state responsibility led to cutbacks in federal spending. Some federal role in financing projects has continued, but under the terms of the Water Quality Act of 1987, this is expected to end in 1994.

Many industrial plants in the United States treat their own effluent, but like the sewage systems to which they are appended, almost all waste water treatment plants in the United States serving municipalities are themselves government-owned. A few cities, however, have chosen to have private firms own or operate treatment facilities. Reasons given for engaging in such arrangements included advantageous tax changes during the early and middle years of the 1980s and lower costs and presumed greater efficiency of the private sector, due to the ability of private firms to profit by cutting costs. Roles played by competition in deciding upon the service provider and terms of contracts themselves have varied. In Auburn, Alabama, for example, the city formally evaluated proposals by four national firms and construction, ownership, and operation were carried through by the winning firm under the terms of a twenty-five-year contract, under which the city paid the contractor an operations and maintenance fee. In Mount Vernon, Illinois, by contrast, ownership has remained in the hands of the municipality, with a private firm upgrading and operating the existing facility in return for a fee adjusted for inflation and volume of effluent processed (Helman and Johnson 1992:133-5).

The 1980 census showed that approximately 80 percent of the U.S. population was served by central sewer systems, a percentage rise of 5 percent compared to the 1970 census, although the actual number of dwellings not served by central systems is actually increasing ("Project Summary: A Statistical Abstract of the Unsewered U.S. Population," USEPA. April 1988:S5-87). The absence of central sewerage systems is most common in rural and urban-fringe growth areas. These areas are largely served by private on-site systems such as septic tanks, although new technologies such as holding tanks and mounds are slowly advancing. Individual onsite septic systems, while often inexpensive and cost-effective, have frequent system failure and frequently create pollution problems. Maintenance and emptying of the facility, as well as transportation and disposal of the wastes, is the responsibility of the private homeowner. States and counties often do not rigorously enforce local sanitation and land-use codes in regard to these systems, creating potentially hazardous situations (OTA 1991:155).

The collection and disposal of garbage and solid wastes

The systematic collection and disposal of solid wastes and garbage by either public or private groups—that is, of various forms of refuse that result from society's daily activities—is primarily a phenomena of the past century or so. Even though there were a few municipal ordinances enacted before the Civil War, in most cities the streets were considered legitimate receptacles for household refuse. It was customary in Chicago, Cincinnati, New York, and southern cities for various types of animals (such as pigs, vultures, or even cows) to act as

scavengers, consuming the various wastes discarded on the street by householders (Armstrong 1976: 433). Even though some larger cities, such as New York, experimented with more systematic collection at mid-century, it was not until the rapid urbanization and large increases in the volume of wastes of the late-nineteenth century that more systematic methods of collection were widely considered. The question of whose responsibility waste collection and disposal was a primary matter of dispute.

Historically, three types of approaches were, and have been, generally followed in the administration of the collection of garbage: municipal collection and disposal by a city department; collection and disposal by private contractors under contract with the city; and separate or private arrangements by householders with contractors or scavengers. However, over time, various combinations also evolved, including municipal and private, municipal and contract, municipal, contract, and private, and contract and private (APWA 1958:271-74). All private contractors were expected to follow the terms of their contracts and to abide by municipal sanitary rules, although there were frequent failures in this regard. Private failure to satisfy municipal contract rules and expectations explains, as it did with waterworks, the movement toward municipal service provision, although there are significant differences in the timing of the change.

Once garbage collection was accepted as a desirable municipal service, cities attempted to accomplish it primarily through private contractors. From 1880 to 1899, for instance, the number of cities who contracted for garbage collection increased from 19 percent to 46 percent, while municipal collection increased from 24 percent to 32 percent. Yet private arrangements dropped from 30 percent in 1880 to 3 percent in 1899 (Melosi 1981:154). The motivation for reliance upon contracting rather than municipal operations is probably explained by the absence of a clear rationale for government involvement—as occurred in the cases of waterworks, sewerage, police, and fire services, all of which were perceived as involving the public health and safety. There was also considerable opposition to government operation in a domain with a substantial set of private operators, as well as municipal opposition to making the necessary capital outlays (Hering and Greeley 1921:156).

During the decade of the 1880s, however, the collection of garbage was increasingly viewed as involving more than the collection of wastes in order to avoid nuisance. A majority of late-nineteenth century physicians and sanitation experts, who believed in the so-called "anticontagionist" theory, emphasized the need for the rapid disposal of organic wastes (such as sewage or food) to prevent the occurrence of epidemic-producing miasmas. Just as cities had moved from private to public provision of municipal water supplies because of concerns over the inability of the private sectors to provide for adequate fire and public health protection, they began to question leaving solid waste removal in the hands of private contractors (Melosi 1992:4-6).

Their concerns were exacerbated by the chaos that characterized this urban service, with frequent changes of venders, the wide-spread use of short-term contracts in the attempt to raise performance standards, and a reluctance on the part of contractors to invest in improved capital equipment. Reformers in the late-nineteenth century concluded that sanitation was too important an urban function to be left in the hands of profit-motivated contractors. They also argued that

municipal operation of waste collection could develop the economies of scale (Hering and Greeley, 1921:155-6).

The late 1890s and the beginning of the twentieth century, therefore, saw cities shifting from reliance upon private contracting for garbage collection to a system of municipal collection and disposal. This trend continued until well after World War II, with municipal collection alone or municipal collection combined with some private contracting serving over 60 percent of the cities (the data is imprecise) while contracting alone shrank to below 30 percent (Melosi 1981:154; APWA 1958:274). Initially garbage collection and disposal was the domain of departments of public health, but as the germ-theory of disease replaced anti-contagionism among public health physicians and practitioners, control over the function shifted to public works departments. Garbage collection was increasingly viewed as an engineering rather than a public health problem but was still a governmental responsibility. Municipalities now focused on preventing solid wastes and garbage from creating nuisances (smells, flies, fire hazards, etc.) rather than health hazards.

Municipal control of solid waste and garbage collection and disposal continued to increase through the 1950s, although many large cities (such as Kalamazoo, Oakland, Portland, San Francisco, and Seattle) used either the contract system or permitted private arrangements (APWA 1958: 273-74). After the late 1950s, however, municipal collection began to decline, and private contracting increased. One factor accounting for the change was the rise of large firms who bought up smaller companies throughout the country in the waste collection area. These agglomerates were able to provide economies of scale, sophisticated management techniques, and efficient collection practices. Other factors included concern over waste-disposal methods and sites because of new environmental regulations and a sharp rise in the costs of disposal as well as a desire to shift labor and operating costs to the private sector. By the 1980s, private contracting was on the rise with a consensus emerging among students of the area that contracting was the most cost effective method of delivering the service (Donahue 1989:58-68)

Electric utilities

Unlike the case of the infrastructures previously described, electric utility service to private consumers has always been funded almost entirely by user fees. Some interesting contractual issues have arisen in the provision of specifically public goods (such as street lighting), but typically, municipalities have paid for these and other public services on the basis of fee structures not dramatically different than those used by ordinary consumers. As in waterworks, private ownership predominated during the early years of electric utilities. Over time, a few large cities (such as Seattle, Los Angeles, and Cleveland) did turn to government ownership. But in sharp contrast to the case in waterworks, private firms have mostly retained their hold in densely populated urban areas, and such government ownership as there is can be mostly found in small cities and rural areas (except for the TVA). While there are about 3,500 separate electric systems in the United States, the largest 200 account for "almost 90 percent of the industry's generating capacity and directly serve nearly 80 percent of the industry's ultimate customer load" (Phillips 1984:583). Today as in the past, most consumers in the United States obtain their electricity from large, vertically integrated, privately-owned service providers.

By almost any measure, privately owned electric utilities in most major cities in the United States simply performed far better than their waterworks counterparts in serving public and private needs. One reason for this relatively good performance is that arranging for provision of specifically public goods (such as street lighting) did not present the sorts of contracting difficulties that so bedeviled relationships between municipalities and privately owned water companies. As with water for fire protection, municipalities and privately owned suppliers of electric street lighting often found themselves enmeshed in long-term relationships, even when short term contracts with provisions for competitive bidding were employed. These relationships were not always entirely peaceable. But under contractual arrangements little different from those for water for fire protection, municipal governments and privately owned service providers found it possible to arrange for service quality to be maintained and increases in demand accommodated with relatively little difficulty and conflict (Jacobson 1989:54-5).

Ease in measuring output and monitoring quality accounted for the difference. Unlike the case of water for fire protection, the output of public illumination being furnished by a privately owned service provider could be specified with reasonable precision in terms of a readily observable and easily measured unit—the number of street lamps operating on a given night. At the same time, the quality of the illumination being furnished could be discerned with the naked eye and easily monitored on a day-to-day basis, at least in a gross way, by policemen and even ordinary citizens reporting lamp outages. Poor quality or unreliable service was not only immediately and indisputably apparent to municipal officials and members of the public but could be easily sanctioned in an incremental and ongoing way, through simple contract terms that set a penalty for each lamp outage (Boston Lamp Department 1891:5).

In addition, even massive increases in demand for street lighting could be accommodated without having to renegotiate the terms of the simple per-lamp pricing structures employed. The number of street lamps operating in a city was a fairly good index of the actual output of public illumination being furnished. At times, disputes broke out between cities and electric utility firms over what constituted a fair price per lamp as costs of labor and material changed, technology improved, and economies of scale increased. But, so long as the price per lamp remained at a level equal to or higher than average costs, even the most opportunistic and unprincipled purveyor of electric street lighting services would have been foolish either to refuse to accommodate growing demand (for which it would be rewarded) or to skimp on quality of service (for which it would be easily caught and penalized, Jacobson 1989:68-73).

Market forces also played a major role in spurring electric utility firms to furnish good quality service to all consumers and to pursue aggressive marketing and investment policies. Particularly during the early years of the industry, electric utility entrepreneurs faced an unpredictable competitive environment rich with opportunities to lose as well as to make money. Limited economies of scale coupled with public policies designed to encourage competition lay at the root of much of this insecurity. Because the voltage of the direct current used by lighting companies during the 1880s and early 1890s could not be easily stepped up or down to match the requirements of consumers, different types of generators had to be used for different kinds of consumption. Arc lights (used for street lighting and other large spaces), incandescent light (used in homes and offices), and traction uses each had to be supplied by different sets of wires and generating units. In the incandescent lighting and small power markets, economies of scale were

further limited by the small size of the distribution areas that could be served by the low voltages of the direct current systems developed by Thomas Edison (Platt 1991:22-39).

At the same time, municipalities in the United States typically issued non-exclusive franchises to electric utility firms, which neither imposed significant constraints with respect to price or quality of service to private consumers nor furnished a significant degree of protection against competition. So long as such policies remained in place, the small size of generating facilities combined with the relatively low cost of stringing wire as compared to laying pipe meant that risks to incumbent firms from duplicative competition were far greater in electric utilities than in waterworks. Although episodes of competition rarely persisted for long, price wars and costs incurred in buying out competitors could result in significant financial strains on privately owned service providers. In addition, even when electric utility firms succeeded (as they usually did) in repealing threats posed by duplicative competition through merger or other means, they still had to compete for market share with entrenched gas utility firms and large consumers who generated their own electricity (Passer 1953).

To survive, let alone grow, in the face of these varied competitive threats, electric utility firms had to furnish a product of high reliability and to keep costs as low as possible. Competitive vulnerabilities arising from limitations on economies of scale also helped to spur technological change. Only by overcoming constraints on scale economies could electric utility entrepreneurs profitably expand their businesses and conquer new markets. During the late nineteenth and early twentieth centuries, some of the most brilliant inventors and best-organized research and development enterprises devoted themselves to attacking the technological obstachles that lay in the way of generating, transmitting, and distributing large outputs of electricity at a low price.

A crucial first step, the introduction by Westinghouse of single phase alternating current, came during the late 1880s. The major advantage of Westinghouse's innovation over the direct current generated by Edison plants was that voltage could be easily stepped up for economical transmission and then stepped down again for use by customers. This meant that individual alternating current generating plants did not have to be built adjacent to major centers of demand in order for a large area to be served. Over the course of the 1890s, the introduction of such innovations as polyphase alternating current made it possible for alternating current to be used for an increasing variety of purposes such as running motors and energizing arc lights. At the same time, rotary converters made it possible for independently constructed direct and alternating current networks to be fed off the same generating plant. Largely in place by the first decade of the twentieth century, these advances laid the technological groundwork for enormous growth in the electric utility industry in coming years and reduced vulnerability to many forms of competition (Wittig 1930:82-92).

Over time, technologically based increases in economies of scale rendered entry by new electric utility firms more difficult while encouraging mergers between existing companies so as to avoid large scale, expensive, and unprofitable duplication of expensive capital investments in generation and distribution facilities (Hughes 1983:106-39). Price reductions made possible by improved economies of scale (as well as technological improvements in lamp efficiencies) gradually reduced the competitive threat to electric utilities from gas companies as well. Although gas lighting remained in use by many domestic consumers well into the second decade of the

twentieth century, the costs of electric street lighting had been so reduced by 1900 that competition from gas companies for street lighting business had virtually disappeared. In a few cities, mergers between gas and electric companies eliminated this competition altogether (Passer 1953:70, 206).

Nevertheless, powerful forms of market discipline on electric utility firms remained. Until the mid-1960s, capacity use needs and growth in economies of scale have continued to provide incentives for electric utility firms to provide high quality and reliable service and to extend their networks aggressively and develop new markets. Because electric utilities could not store significant amounts of power for future use, maintaining the ratio of average to peak consumption (load factor) at a high level was, and is, of critical importance for utilities to obtain a high level of remuneration from their increasingly large-scale and expensive capital facilities.

At least in densely populated urban areas, these forms of market discipline meant that protection of consumer interests never depended upon the efficacy of franchising and regulatory arrangements in electric utilities to nearly the same extent as in waterworks. As in other infrastructures, exact forms taken by these arrangements differed from case to case but certain common themes and trends can be discerned. In many although not all states, municipal franchising of private electric utilities was partially or entirely supplanted by state regulation during the first two decades of the twentieth century. By 1935, regulatory commissions usually appointed by governors and possessing the authority to set rates and to protect electric utility firms against duplicative competition had been put in place in thirty seven states and the District of Columbia. In most cases, the political coalition supporting imposition of regulation included both good-government reformers and utility executives. For reformers, regulation represented a solution to problems of municipal corruption. For utility executives, state regulation represented a means to stave off more stringent municipal ownership and regulatory initiatives and gain legal protection against even the threat of duplicative competition (Anderson 1981:56).

In practice, state regulators generally did not constrain decisionmaking by privately owned service providers in significant ways. In nearly all states, commissions could not begin cases on their own initiative. In the context of declining costs that characterized the industry, the high costs of initiating and carrying through a complaint worked to the advantage of utility firms (Mosher 1929:19-20). Other constraints faced by regulatory commissions included inadequate staffing; lack of jurisdiction over wholesale interstate power sales; and the likelihood of disruptive, time-consuming, and inconsistent judicial intervention for any regulatory decision opposed by utility firms.

Significant federal involvement in the affairs of private utility firms was initiated during the mid-1930s amidst economic depression and efforts by President Franklin D. Roosevelt to reform the distribution of economic and political power and stimulate the economy. With respect to private electric utilities in particular, the main impetus for regulatory reform came from concern about financial abuses on by holding companies and undue and unaccountable concentrations of power in the hands of those who controlled them. In response to perceived abuses, legislation enacted in 1935 gave the Federal Power Commission authority to regulate wholesale prices for electricity marketed across state lines. At the same time, the Securities and Exchange Commission was given the authority to regulate holding companies' ability to issue securities, to

order them to simplify their corporate structures, and to require service organizations to serve operating companies at cost. Most importantly, the law mandated outright dismemberment for holding companies that did not serve geographically unified areas (Twentieth-Century Fund 1948:43). Unlike the case with the state regulation described previously, these reforms were carried through over the strenuous opposition of the private electric utility industry. Although a few regional holding companies survived, federal interventions left the United States with an electric utility industry consisting predominantly of independent, vertically integrated private firms.

Expansionary electric utility development of the sort that had first accelerated during the late nineteenth and early twentieth centuries reached its high mark in the United States during the two decades following World War II. Technological improvements in the generation and transmission of electricity continued to lower the cost of generating and transmitting electricity. At the same time, despite The New Deal reforms of the 1930s, neither federal nor state regulatory commissions exercised rigid control over rates of return earned by private electric utility firms or offered much oversight.

Under predominantly private rather than government ownership, expansionary development of electric utilities, like that of waterworks, became increasingly controversial from the late 1960s onward. Unlike the case during previous eras of controversy, the most heated debates now centered not on which form of ownership or regulation represented the best means of maximizing the production and consumption of electricity but on the desirability of this goal. With the rise of environmentalism, many people would come to see continued growth in the use of energy not as enhancing human welfare but as dangerous to public health and irrational in environmental terms (De Bell 1970:66). As in waterworks, assumptions that unlimited growth was desirable in the power sector also began to come under criticism on economic grounds (Energy Policy Project 1974:325-43, Lovins, 1977).

Pursuit of traditional growth paths by electric utilities also became more difficult during the late 1960s because there were fewer incremental advances in generating technology of the kind that had brought about steady increases in efficiency over the previous fifty years. Efforts to lower costs through exploitation of scale economies also proved increasingly difficult as large new plants proved more costly to build and less reliable than expected. The problems arising from scaling up were particularly severe with respect to nuclear power plants but bedeviled conventional thermal facilities as well (Hirsh 1989:89-142). The combined result of soaring rates of inflation and exploding energy costs during the 1970s was that, after years of decline, the average and marginal cost of generating electricity began to increase. In large part as a result of these shocks, growth in electricity consumption in the United States during the 1970s was less than half that of previous decades. Energy prices as a whole stabilized during the 1980s and oil prices actually fell, but average rates of growth in the consumption of electricity continued in the range of two to three percent a year (Moody's 1992a:22).

Despite all of these shocks and controversies, proportions of private and government ownership in the electric utility industry have remained more or less the same since the 1930s. But roles played by the government and by markets have both increased in certain respects. During the 1970s and 1980s, environmental concerns would be translated into increased

regulation over pollution discharges. Government involvement in the siting of facilities also increased (Hirsh 1989:151). In many states, shifts from declining to rising costs raised the political profile of electric utility issues and inspired unprecedented activism on the part of regulatory commissions in pursuing their traditional oversight functions with respect to rates and service (Anderson 1981). Since the late 1970s, federal legislation has also played a role. Laws enacted in 1978 and 1992 have mandated that states take into account principles of marginal cost pricing and least-cost planning in carrying through their own regulatory activities.

At the same time, efforts have been under way to restructure the electric utility industry itself along more competitive lines. Here, too, it has been federal legislation that has been the driving force. The Public Utilities Regulatory Policies Act of 1978 required utility firms to buy electricity from small, unregulated, independent cogenerating plants and facilities that relied on renewable resources. The initiative was justified on both environmental and energy conservation grounds. The Comprehensive National Energy Policy Act enacted into law in 1992 extended these principles still further. Largely motivated by a desire to increase competition in the electric utility industry, the act reduces regulatory restrictions on independent power producers of all sorts and increases the authority of federal regulators to order access to utility transmission facilities (Rosenzwig 1993:17).

Most electricity in the United States continues to be furnished by vertically integrated, privately owned utilities enjoying a monopoly over distribution in their service areas. As a result of these acts, however, independent nonutility firms have begun to generate a significant portion of the country's electricity and bulk power markets have increased in importance. A number of conflicts emerged over the terms of these arrangements over the course of the 1980s. In general, for example, independent generators sought to promote a regulatory regime in which both access to transmission lines was as open as possible and privately owned utilities were compelled to bind themselves to the purchase of power from the independents under long-term contracts. Privately owned utilities, by contrast, often (although not always) sought to keep as much control as possible over their transmission facilities and opposed requirements to purchase power from independents under long-term contracts. While independents relied upon such contracts to ensure that their investments would be recompensed, many utilities claimed that they reduced flexibility. Even if the independent generator had an initial cost advantage, many utilities claimed, changing conditions sometimes resulted in their being forced to purchase power at higher costs than generating it themselves (Jordan 1991, Swidler 1991).

Telephones

The history of telephone service in the United States both parallels and diverges from that of electric utilities in some interesting ways. Both industries began during the late nineteenth century and, as from the beginning in electric utilities, service to private consumers has been recompensed almost entirely by user fees . Over the course of the twentieth century, telephone as well as electric utility networks have come to encompass the entire country, as technological improvements in both industries made for enormous declines over time in the real costs of providing service. From the mid 1930s to the mid 1980s, for example, the number of simultaneous conversations that could be carried over a single coaxial cable increased from less than 500 to over 32,000. Beginning in the late 1940s, the development of microwave relay

systems has contributed to further declines in the cost of transmitting long-distance calls, as has the recent development of fiber-optic technology. At the same time, deployment of switching systems of increasing sophistication has dramatically lowered the costs of routing calls and increased the range of communication services that can be furnished over the network.

But there are also differences. From the beginning, dominance by privately owned service providers has been even greater in telephones than in electric utilities. To a far greater extent than in electric utilities, development of telephone networks has involved coordination of investment and operation on a national and even international scale, resulting in a different organization of the industry. In electric utilities, over time, vertically integrated privately owned service providers operating on a local, and eventually regional, scale have furnished the bulk of service. In telephones, by contrast, a single firm has dominated virtually from the beginning.

From almost the start of the industry until 1984, the bulk of the local and long-distance telephone service in the United States was furnished by the American Telephone and Telegraph Company. By the last decades of the nineteenth century, the firm's management had succeeded in parlaying its access to large pools of capital and early control of the Bell telephone patents into a position as the supplier of the bulk of the local and long-distance telephone service in the United States. After expiration of the Bell patents in 1893, a large number of independent telephone companies were founded in both urban and rural areas. But with the help of its control of long distance lines and superior resources, Bell was able to buy out or eliminate most competitors in major centers by the end of the first decade of the twentieth century (Garnet 1985:131). This dominant position was maintained in subsequent years, and AT&T became the largest corporation in the United States.

The telephone company, like its electric utility counterparts, would come under the jurisdiction of state regulatory commissions during the first and second decades of the twentieth century. But to a greater extent than in electric utilities, provision of service involved transactions that crossed state lines. As a consequence, federal involvement started earlier, beginning in 1910 with enactment of the Mann-Elkins Act, which gave the Interstate Commerce Commission jurisdiction over prices charged for interstate and international telephone and telegraph and cable services. In practice, during the early years of its jurisdiction, the ICC made minimal efforts to set or control rates, but it did make valuation studies and set up a uniform system of accounts.

As in electric utilities, Depression-era reforms brought about more extensive federal involvement. In particular, the framework of rate regulation was elaborated more fully after passage of the Federal Communications Act in 1934. The act placed regulation of interstate telephone service under the jurisdiction of a newly established Federal Communications Commission (FCC). The commission pursued a detailed investigation of the costs of telephone service and established a framework of continuing surveillance for setting future rate levels by informal negotiations. But unlike the case of electric utilities, the federal government did not order a restructuring of the industry at this time. The rationale seems to have been that the telephone network was functionally integrated on a national scale in a way that the electric utility holding companies were not (Phillips 1988:677-756).

Nevertheless, from early in the twentieth century, the dominance of American Telephone and Telegraph was attacked as representing an undue and unaccountable concentration of political as well as economic power. These attacks were not entirely without effect, and during the early decades of the twentieth century, legal action centered mainly on efforts to prevent American Telephone and Telegraph from buying out or destroying independent local service providers. In response to an early antitrust suit, for example, in 1913 American Telephone and Telegraph agreed to give small independent telephone companies access to its long-distance network and promised not to acquire competing firms (Garnet 1985:153-54). The Hall Memorandum, signed in 1922, reinforced these commitments, although by this date American Telephone and Telegraph's dominance in major population centers was secure.

Since World War II, legal and governmental action has centered on efforts to increase competition in those areas of the telephone industry in which economic considerations do not justify monopoly. In 1949, the federal government filed a civil antitrust suit calling for American Telephone and Telegraph and its equipment manufacturing subsidiary Western Electric to be split up. At least in theory, such a split would result in increased competition in the equipment manufacturing market and ultimately more choice and lower costs for consumers. The suit was settled in 1956 with an agreement by American Telephone and Telegraph to pursue a more liberal policy in licensing patents. The company was also restricted from entering non common carrier telephone businesses. Otherwise, however, the settlement left American Telephone and Telegraph intact.

More radical change occurred in subsequent years. During the 1960s and 1970s, new technologies such as microwave transmission made it possible for firms to compete for long-distance business at relatively low cost. American Telephone and Telegraph continued to furnish almost all long-distance service, but over time, a series of FCC decisions began to reduce legal barriers to entry, and competing firms such as MCI began to provide service in a few markets. Settlement of a civil antitrust suit filed by the federal government in 1974 ended American Telephone and Telegraph's monopoly in long-distance markets entirely. Settlement of the suit approved in 1982 broke the links between American Telephone and Telegraph's long-distance and local operations. Still regarded as a natural monopoly, local telephone service continued to be carried by regional companies. Long-distance markets, on the other hand, were opened to competition, and since divestiture in 1984, some competition has emerged in long-distance markets, as expected. Interestingly, this has taken place in a context of continued judicial and regulatory restraint on American Telephone and Telegraph designed to prevent the firm from using its existing dominance to crush new competitors through aggressive pricing or other means (Phillips 1988:677-756).

Technological developments during recent years, such as the development of cellular and other wireless systems of telephony, seem to be increasing potential for competition for local telephone service. Thus far, at least, effects have been limited and the vast majority of telephone calls are still carried through the lines and switches of the existing network. Future developments, of course, are uncertain. Based upon existing experiences, however, it is likely that changes in technology alone may be insufficient to sustain higher levels of competition in the future. Restrictions on mergers of competing firms may be needed as well as requirements for network access in order to prevent new competitors from being frozen out by incumbent firms

Comparative analysis: Great Britain and France

Extended discussion of infrastructure developments in Great Britain, France, and other countries lies beyond the scope of this report. But even brief examinations of the histories of a few infrastructures in different countries can shed light on some of the ways in which ideas, institutions, and attributes of infrastructures themselves have shaped choice and functioning of forms of ownership. As in the United States, the sheer range and variety of arrangements employed at different times and places has been enormous.

In general, government ownership has been the dominant approach in the United States and throughout the world for infrastructures (such as roads and streets) for which user fees are seldom charged. For infrastructures in which service providers are commonly recompensed all or in part by user fees (such as telecommunications networks, waterworks, and electric utilities) the range of variation is greater. While provision of telegraph as well as telephone service in the United States has always been provided by privately owned firms, for example, state ownership has predominated in France, Germany, Switzerland, and other European countries. Decisions as to development as well as ownership of these systems in many cases was also shaped to a much greater extent in Europe than in the United States by considerations of national unity and military need (Holcombe 1911; de Gournay 1988:322-38).

With respect to waterworks and electricity, in Great Britain (as in the United States at the outset of the twentieth century) oversight and direct provision of many infrastructures lay in the hands of a complex web of entrenched local municipalities and authorities. But unlike the United States, Great Britain was and is a unitary state. In the British context, this has meant that, with some exceptions, a ruling party in the House of Commons could make decisions concerning the provision of infrastructures virtually unchallenged by independent courts, executives, or other legislative bodies. Until the 1980s, this power was generally applied to create public bodies that could break through jurisdictional barriers to the exploitation of scale economies in the provision of infrastructures. As in the United States, a majority of Great Britain's urban population obtained their water from government-owned systems during the first decades of the twentieth century, although a few private companies owned and operated systems under monopoly franchises. Since World War II, however, involvement by the national government in organizing the industry has been substantially greater in Britain than in the United States. A National Water Act passed in 1945 provided inducements for municipal and local systems to amalgamate for the purpose of increasing efficiency. Under the terms of the Act, the number of separate water supply systems in England and Wales was reduced from 1,400 during World War II to 187 in 1974.

New legislation enacted in 1973 in England and Wales brought about massive consolidation of the provision of both water and sewerage services. On the rationale that conservation and environmental protection needs at the outset of the twentieth century required planning and decisionmaking that took into account the requirements of entire regions and watersheds, management of the country's government-owned waterworks and sewage systems was placed in the hands of ten regional water authorities. In addition to provision of water and sewerage services, the water boards were also given responsibility for administering pollution control regulations. Under this regime, during the 1980s, individual metering of households began for the first time in Britain. Criticisms of the arrangement included claims that waterworks

investment remained inadequate (due to public sector borrowing limits) and charges that placing environmental regulation in the hands of service providers made for inadequate checks on the power of system managers (Maclean 1991:37-54).

In electric utilities as well, extensions of government ownership and the breaching of jurisdictional barriers to exploitation of economies of scale went hand in hand. From the beginning, a far greater proportion of British than American municipalities established their own electric utility undertakings. From 1900 through 1948, municipal undertakings accounted for a two-thirds share of all electric utility sales in Great Britain. Municipalities dominated in densely populated urban centers, while private supply was more common in outlying areas—a pattern exactly the reverse of that in the United States (Hannah 1979:214-23).

The impetus in 1926 for the first major restructuring of Great Britain's electrical utilities came from perceptions that the small scale of the country's electrical utilities was so inefficient that national prestige and economic prospects were threatened. A broad consensus among Britain's political leadership had developed concerning this issue, and Stanley Baldwin's conservative government presided over the reform. In response to problems and high costs arising from the small scale of both private and government-owned utilities, Parliament established a new, quasi-public entity to build a national grid that would link systems and to coordinate the investment in and operation of generating plants.

Under the plan, existing government and privately owned utilities retained ownership of generating and distribution systems, but a newly created Central Electricity Board was placed in charge of the construction and operation of a nationwide transmission network. The board bought the electricity produced by undertakings, determined the use made of existing generating plants, and oversaw the planning of new capacity. In many respects, the organization created to carry through the work resembled the public authority arrangements under development in the United States during the same period. The organization represented a form of government in that ownership was in the hands of the state and officials were appointed. All equity remained in the hands of the state, with private capital only being drawn on in the form of bonds. Members of the board were appointed for five-year terms by the Minister of Transport and could not be dismissed. Managers and engineers drew government salaries but were not part of the civil service (Hughes 1983:350-62).

In 1947, the entire electric utility industry was nationalized. Although carried through by a Labour government as part of a broader effort to reshape British society, the shift was in some respects quite modest. Since, by 1947, the bulk of Britain's electric utility industry was already in government hands, it can be interpreted as a continuation of previous efforts to centralize the electric utility industry so as to better exploit economies of scale. But despite the creation of the grid and substantial consolidation, more than 600 franchised electric supply undertakings still operated, of which about 200 accounted for 90 percent of sales and investments (Hannah 1979:213). Requirements for the Central Electricity Board to purchase electricity from these undertakings introduced both coordination difficulties and rigidities of various sorts. The act nationalizing the industry consolidated these undertakings into twelve new regional distribution corporations. Generating and transmission was placed in the hands of a Central British Electricity Authority.

But concentration of government power at the center has also made it possible for radical change to be implemented in different directions. As part of a broader conservative program to reduce the role of the government in the economy and create an "enterprise society" during the 1980s, Great Britain initiated a sweeping privatization program encompassing a wide array of infrastructures and industries, including both waterworks and electric utilities (Vickers and Wright 1989:1-30; Heald 1989:31-48; Grimstone 1989:103-17). At least in water and electricity, however, this has not meant a simple reversion to earlier patterns of industry structure and ownership. In waterworks, the 1973 division of the country into ten regional service areas survived. Privatization consisted of selling off equity in the monopoly water and sewerage provider in each region to private investors. No direct competition in the provision or management of services was envisioned. A new national regulatory agency headed by a single individual (the Director General of Water Services) was given responsibility for protecting consumer interests and ensuring that the service provider did not exploit its monopoly position. In addition, responsibility for environmental regulation was placed in the hands of a new National Rivers Authority (Maclean 1991:37-54).

In electric utilities, on the other hand, an effort was made to both preserve the economies of scale opened up by previous reform efforts and simultaneously to increase the role of competition in protecting consumer interests and inspiring entrepreneurial vigor. Two separate generating companies were created so as to introduce at least a measure of competition. The twelve distribution companies created by privatization were also given the authority to supply a small portion of their own electricity as a further source of competitive discipline in generation. Retaining a unified national transmission network was seen as indispensable if competition in bulk power markets were to have even a chance of developing. Ownership was placed in the hands of the twelve distribution companies so as to help to ensure that monopoly would not be abused by suppliers of bulk electricity. As in waterworks, a new national regulatory agency (the Director General of Electricity Supply) was set up to oversee the entire arrangement (Roberts, Elliott, and Houghton 1991).

France has had somewhat different patterns, with privately owned service providers furnishing much greater amounts of water in urban centers than in either Great Britain or the United States. But whereas privately owned utilities furnish the bulk of the electricity consumed in the United States, provision in France is entirely in the hands of a single nationalized company. This outcome can be accounted for in part by differences in structures of political institutions and political culture. France, like the United States, has long presented a picture of fragmented local government. From the time of the French Revolution to the present, the country has been divided into more than 36,000 local communes responsible for many local governmental functions and service provision. These units have been jealous of their authority but are often quite small in size and possessed of limited financial and administrative resources. While intergovernmental cooperation between communes has occurred in the provision of services, fragmentation of governmental authority seems to have favored private provision as it has in the United States. In such a setting, private waterworks and construction firms have found it possible to acquire the technical and administrative capabilities and economies of scale in the construction and operation of infrastructures to a greater extent than have the communes (Lorrain 1992).

Whereas in the United States the bulk of the urban population is served by government owned waterworks, in France only 34 percent of the waterworks in the central communes of urban areas (population of 23,000 or more) are both owned and operated by the government. On the other hand, only 12 percent of such systems are both owned and operated by private water utilities. In the bulk of cases, private firms administer and operate waterworks even collecting charges from customers, while the physical facilities themselves remain in the hands of the communes. As in the United States, French waterworks and other municipal infrastructures during the nineteenth century were either franchised out to privately owned service providers or both owned and operated by municipal governments. Over time, however, "this dual pattern quickly underwent a number of modifications, all of which tended to attenuate the differences. Jurisprudence added guaranteed result clauses to the franchises. Other types of contracts were developed at the same time. Their common feature was that they combined private management with public financing and a transfer of ownership to the public sector for the most costly equipment such as water and waste treatment plants, and sewage stations" (Lorrain 1992: 84).

The continued viability of private involvement in the provision of water in French urban centers is partially explained by factors similar to those which shaped the functioning of franchise and contract arrangements in U.S. waterworks and electric utilities. By allowing for private firms to operate but not to own waterworks facilities, many French cities seemed to have sidestepped the difficulties in arranging for investment that so plagued their American counterparts. Secondary accounts of experiences in French cities emphasize the long term character of the relationships built up between municipalities and privately owned service providers. Nevertheless, the French separation of ownership from operations unquestionably made possible shorter contract lengths and may have increased the role of recurrent bidding as an inducement to good performance.

In addition, at least during the nineteenth century, demands for expansion and ongoing rebuilding of urban waterworks were smaller in France than in the United States. Starting from a much smaller base, major cities in the United States grew far more quickly than did their counterparts in France. Patterns of land use also differed. Building densities in French cities were fairly uniform. In the United States, by contrast, outlying residential areas sprawled even as the cores of major cities became packed with tall buildings. This pattern of growth made for heavy demands for water main extensions to serve outlying areas and for water main enlargements, both to serve consumers and to protect against fire in the increasingly built-up centers.

Furthermore, the great bulk of residential, commercial, and even industrial structures in most cities in the United States were made of wood, with highly flammable "balloon frame" construction dominating from the 1830s onward. Without adequate waterworks capabilities, even small fires could easily develop into city-destroying conflagrations in such a setting. Due to both differences in factor endowments and far stricter building codes than in the United States, by contrast, most cities in France were built predominantly of stone and brick and other relatively fire proof materials. As a consequence, protection against conflagration in French cities required less investment in waterworks facilities to meet day-to-day consumer needs than in the United States (Sutcliffe 1981:99-128; Rosen 1986:95-108).

Electricity development in France also occurred under the jurisdiction of the communes, and here, too, at least the possibility for evolution of such mixed arrangements existed. But unlike the case of waterworks, informed opinion during the 1920s began to view construction of inter-connected systems on a regional or even national scale as desirable. But with oversight in the hands of the communes, numerous jurisdictional and political obstacles obstructed such development. One author described the situation during the 1930s as follows:

> The maze of rival institutions made systematic interconnection ever more elusive and supply efficiencies suffered accordingly. Local authorities were unable to develop gridding strategies among districts and when private utilities developed interregional transmission links, regies [systems owned by communes] and co-ops lacked protection against monopolistic pricing practices. Thus by the onset of the Depression, several problems in the utility industry were becoming clear: efficiency seemed to require centralized control, yet many citizens were reluctant to allow the controlling power to reside in private hands. At the same time, measures reinforcing local autonomy militated against the very centralization that efficiency criteria seemed to warrant (Frost1991:13-14).

The situation after World War II was even worse. The war left France's electric utility industry with extensive physical damage to transmission facilities and generating plants. Reconstruction demanded large infusions of capital, yet utility firms themselves were nearly bankrupt. Indeed, the firms did not even have enough money on hand to pay for the imported coal needed to fuel their existing generating plants. Faced with price controls and investor fears of expropriation, raising the capital needed to rebuild was out of the question.

But France, like Great Britain, possessed a unitary national government that could cut through this sort of impasse, and in 1946 it enacted legislation nationalizing virtually the entire electric utility industry. A case can be made that less radical steps such as the lifting of price controls or the granting of subsidies to France's private utility firms might have served to alleviate the immediate crisis faced by the industry. But many elites across the political spectrum viewed the sorts of institutional bottlenecks that had obstructed industry development during the 1920s and 1930s as even more intolerable in light of the need for abundant power for economic development and for building a new and better society in the post-war world.

> A huge and heroic hydro program envisioned by Resistance study groups would end a dangerous dependence on [imported] coal, alleviate trade deficits, and contribute to national energy independence. Gargantuan dams were to be icons of a new, modernized France, just as they had been in the United States with the Norris, Shasta, and Grand Coulee projects. Experts and politicians agreed that a utility (and preferably hydro) boom was essential for France's economic revival (Frost 1991:36-37).

Particularly on the left, nationalization was also supported as a means to reduce class divisions, build a more egalitarian society, and eliminate the undue and corrupting influence of utility owners on politics (Frost 1991:39-58).

Conclusions

This report presents a summary of the rich and varied experiences of both private and public sector entities in the provision of urban services in the United States, France, and Great Britain over the last hundred years. The main focus, on private, profit-seeking firms, shifts back and forth between the private and public sectors and other forms of operational and fiscal arrangements. Forms of organization (such as rural electric distribution cooperatives and other locally based non-profit yet nongovernmental entities) receive scant attention here, not because they are unimportant but because they have sufficiently unique attributes to deserve separate and extended discussion and analysis.

As can be seen in the preceding accounts, private firms have played a wide range of roles in the provision of infrastructures as owners, operators, lessees, contractors, and builders of facilities. Private firms and propertyowners associations of various sorts have owned outright both toll roads and residential streets in the United States. Solid waste collection in American cities has been carried out by private firms paid for directly by consumers and under contract with municipal governments. Urban transit has been provided by private firms under a range of franchise, contracting, and regulatory arrangements in the United States and Great Britain. While waterworks facilities in France are predominantly government owned, private firms operate and manage the bulk of systems under an array of contracting and leasing arrangements. Throughout the world, portions of many of the infrastructures owned and operated by governments have been built by private firms.

Decisionmaking concerning infrastructure development, sorts of public goods demanded, and roles played by private firms has been shaped by the values of politically important actors and the workings of governmental, political, and legal institutions. With respect to the role of private firms specifically, beliefs as to the "publicness" of different goods and services have been of crucial importance in shaping the character of regulatory, franchising, and contracting arrangements. In situations in which a good has been seen as predominantly private, it has been possible for privately owned service providers to be compensated predominantly from user fees and to leave to them the bulk of decisions as to price, output, and quality of service. By contrast, when goods have been seen as public and subsidized from tax payer revenues or provided entirely free to consumers, many decisions as to price, output, and quality have had to be made by government agencies, no matter what the role played by privately owned service providers in actually furnishing outputs.

Goods defined as "public" have often been provided free to users, even though exclusion of nonpayers would impose few technical difficulties. Examples from the United States would include the interstate highway system, public parks, public libraries, and police and fire protection services. The reasons for defining such goods and services as public and furnishing access free of charge have included economic development goals and the idea that, in some domains of public and civic interaction, market relations do not apply. Others hold that exclusion of nonpayers from parks, streets, and other places defined as public could amount to a denial of political and individual rights. Probably the single most important change in recent years along this dimension has been the growing importance of environmental concerns. Concern for the environment has increased demands for investments in types of infrastructures such as wastewater treatment plants.

At the same time, increased attention has been drawn to the public "bads" (as well as the public goods) of developing many sorts of infrastructures (including highways, large dams for provision of electricity, urban water supply, and irrigation, and conventional and nuclear thermal electric generating plants).

Choices as to private and governmental provision of infrastructures have also been shaped by ideas and ideals concerning the role of the state in the economy. The far greater role played by private firms in the provision of electric utilities in the United States than in Great Britain during the early years of these industries, for example, can be attributed in substantial part to broad differences in beliefs concerning appropriate roles for governments to play in furnishing and overseeing essential services. The much larger role of the state in furnishing telecommunications services in continental Europe than in the United States can also be understood, at least in part, in these terms. Issues in other domains have also shaped debate and decisionmaking at various times. In both the United States and Great Britain, for example, the contracting out of public services has been both supported and opposed because of its potential to break the power of public sector unions and to reduce workers' pay. In the United States, at least, issues of social and racial justice are also involved because government employment has historically offered avenues of advancement to members of some minority groups. Privatization, some fear, may choke off such opportunities (Suggs1989).

Experiences with private involvement in the provision of infrastructures have been shaped by contingencies of political and institutional development and idiosyncrasies of time, place, and circumstance. Constraints on geographical expansion faced by government and privately owned systems have been particularly important. In the case of electric utilities in the United States, for example, distribution by municipally owned systems has generally been confined to service within the boundaries of individual cities, while private firms could extend their lines with far less regard for jurisdictional boundaries. In such a setting, privately owned electric utilities could exploit economies of scale opened up by new technologies in ways denied their municipally owned counterparts. In Great Britain, by contrast, both government and private systems faced constraints on expansion. Creation of a quasi-public national grid in 1926 was supported by many private as well as government-ownership advocates as simply the most practical route to break the log jam created by inefficient distribution.

Certain commonalities can be discerned in experiences with the private provision of infrastructures. As economic theory predicts, lack of direct competition and provision of service through long-lived, capital-intensive, and networked facilities have consistently gone together in a wide range of contexts. Where heavy facilities of this sort are in place (such as water mains and sewage lines), competition has been almost unknown. In intermediate cases (such as telephone and electric utility networks, in which costs of stringing wire are comparatively low), competitive episodes have usually proven short-lived. Interestingly, just about the only cases of sustained competition between electric utility distributors in the United States has been in cities such as Cleveland, in which one of the competitors was government-owned. Where fixed facilities play a comparatively limited role (as in intercity bus transport, urban taxis, garbage collection, water delivery by water carriers, etc.) sustained competition between private firms has been more common although many examples of monopoly can be found in this domain as well.

A second common theme has been longevity of tenure. In situations in which private firms actually own fixed and long-lived infrastructure facilities, displacement of existing service providers by new entrants has been quite uncommon, even in situations in which contracts or franchises have been recurrently put out to bid. Contract lengths can be shorter and recurrent bidding may be more powerful as a source of accountability under arrangements in which private firms operate but do not own facilities. Waterworks and other services in many cities in France are furnished under such arrangements. But even here, long tenures have been the norm. This theme, too, is consistent with economic theory (Williamson 1985:61-63).

Policymakers seeking ways to improve infrastructure provision in developing countries through increased private sector involvement are unlikely to confront circumstances exactly identical to those in the United States, France, or Great Britain. Indeed, experiences with different ownership and regulatory arrangements have been quite varied even in these countries To an even greater extent, the competition in domestic markets for goods and services, well-developed capital markets, and effective administrative structures of the United States, Great Britain, and France, cannot be assumed to be present in many developing countries (Persaud 1992).

At the same time, however, common factors can be identified that have consistently shaped outcomes in the context of the limited direct competition and long tenures characteristic of many forms of private involvement in the provision of infrastructures under even the best of circumstances. Lessons of the past cannot be uncritically applied by contemporary decisionmakers without close attention to context. Yet the very fact that some similar factors can be identified as shaping outcomes amidst diverse contexts in the United States, France, and Great Britain is at least suggestive of possibilities for broader applicability.

One set of factors concerns the extent to which privately owned service providers are motivated to perform well without imposing demands on enforcement and regulatory arrangements and the administrative capacities of government agencies. Burdens on oversight arrangements depend in part on market incentives faced by private firms. For reasons described previously, the role played by direct competition between privately owned firms is likely be quite attenuated in many situations, even if contract duration is short and recurrent bidding is attempted. Market incentives can arise from other sources, however, and in such cases the profit motive can be a powerful spur for efficiency, innovation, and responsiveness to consumer demands on the part of privately owned service providers. In the case of electric utilities in the United States, for example, the increased profits to be realized by increasing off-peak demands and inter-product competition functioned as market incentives for good performance during the first decades of the twentieth century. As a result, state regulators intervened little in private decisionmaking.

As noted previously, decisions as to pricing are also of crucial importance. In situations in which service providers are compensated entirely from user fees and a degree of market discipline is present, burdens of decisionmaking and enforcement faced by government agencies may be quite light. When a good or service is subsidized or furnished free to consumers in order to achieve some public purpose, on the other hand, contracting arrangements of one sort or another may be needed. Such contracting can be a relatively straightforward matter if output and quality

of service is easy to specify and monitor. Even under static conditions, however, the problem of devising a workable, long-term relationship between contractor and contractee may be far less tractable in cases in which output and quality are difficult to specify in unambiguous terms. As could be seen in the case of water for fire protection in the United States, the new difficulties arise under conditions of change. Under such circumstances, problems and conflicts in renegotiating contract terms with private vendors can result in rigidities that exceed those of all but the most rigid of public bureaucracies.

Clearly, attributes of markets and extents to which infrastructures serve public purposes both bear close examination in considering whether and how to increase roles played by private firms. The findings also have some more subtle implications that relate to the administrative capabilities of governments themselves. One of the major advantages of privatization is that it can reduce the role of government bureaucracies in performing entrepreneurial activities for which they may be poorly suited. At the same time, however, overseeing provision of specifically public services by privately owned service providers and ensuring that such competition as is possible does take place are also activities that require substantial expertise and developed administrative capabilities on the part of government agencies. Where market forces are weak and important public interests are at stake, therefore, the strengthening of governmental institutions may be a prerequisite for successful privatization.

The form taken by privatization may also be important. In both Great Britain and the United States, infrastructure policy has involved not only shifts between private and governmental provision but interventions into the structures of privately owned service providers themselves. Examples of such interventions include the restructuring of Great Britain's electric utilities during the 1920s and the break-up of American Telephone and Telegraph during the 1980s. Exploitation of opportunities afforded by new technologies to exploit economies of scale or increase competition were among the objectives in both cases. Particularly for smaller, developing countries dependent upon multinational corporations for infrastructure investments, however, such direct interventions into corporate structure may not be feasible as means to adjust to changing conditions.

In such cases, opportunities to benefit from competition between private firms and to flexibly accommodate changing conditions may be maximized by retaining ownership of fixed assets in government hands even as construction or operation are contracted out. Such approaches have been used to develop waterworks not only in France but in the Côte d'Ivoire (Roth 1987:263-64). Depending upon circumstances, other alternatives (such as provision by independent non-profit organizations or some other sort of quasi-public entity) may be worthy of consideration as well.

None of these choices, of course, should be viewed as a panacea. Trade-offs are unavoidable, their magnitude cannot always be easily ranked in advance, and matters do not always play out exactly as expected. What is clear, however, is that for any evaluation of different private and public alternatives for the provision of infrastructures to have even a chance of producing realistic results, local contexts and the affects of time, change, and other contingencies must be taken into account.

References

American Public Works Association. 1958. Refuse Collection Practice. 2nd ed. Chicago.

American Waterworks Association. 1925. Waterworks Practice. Baltimore: Williams and Wilkins.

Anderson, Douglas. 1981. Regulatory Politics and Electric Utilities. Boston: Auburn House.

Anderson, Letty. 1980. "The Diffusion of Technology in the Nineteenth Century American City: Municipal Water Supply Investments." unpublished dissertation, Northwestern University.

Armstrong, Ellis L., Michael C. Robinson, and Suellen M. Hoy, Eds. 1976. History of Public Works in the United States 1776-1976. Chicago: American Public Works Association,.

Beito, David T. and Bruce Smith. 1990. "The Formation of Urban Infrastructure Through Nongovernmental Planning: The Private Places of St. Louis, 1869-1920," Journal of Urban History. Vol. 16, May.

Boston Lamp Department. 1892. Annual Report of the Lamp Department for the Year 1891. Boston.

Bruchey, Stuart. 1965. The Roots of American Economic Growth 1607-1861. New York: Harper & Row.

Davidson, R.K. 1957. Price Discrimination in the Selling of Electricity and Gas. Baltimore: Johns Hopkins.

De Bell, Garrett. 1970. "Energy." In Garrett De Bell, ed., The Environmental Handbook. (New York: Ballantine.

de Gournay, Chantal. 1988. "Telephone Networks in France and Great Britain" in Joel A. Tarr and Gabriel Dupuy eds., Technology and the Rise of the Networked City in Europe and America. Philadelphia: Temple University.

Energy Policy Project of the Ford Foundation. 1974. A Time to Choose: America's Energy Future. Cambridge: Ballinger.

Frederick, Kenneth and Dianna C. Gibbons. 1986. Scarce Water and Institutional Change. Washington D.C.: Resources for the Future.

Frost, Robert L. 1991. Alternating Currents: Nationalized Power in France, 1946-1970. Ithaca: Cornell University.

Garnet, Robert W. 1985. The Telephone Enterprise: The Evolution of the Bell System's Horizontal Structure, 1876-1909. Baltimore: Johns Hopkins.

Gomez-Ibanez, Jose A. and John Meyer. 1992. The Political Economy of Transport - Privatization: Successes, Failures and Lessons From Developed and Developing Countries. Cambridge: John F. Kennedy School of Government.

Gould, Jacob Martin. 1946. Output and Productivity in the Electric and Gas Utilities: 1899-1949. New York: National Bureau of Economic Research.

Grimstone, Gerry. 1989. "Privatization: Macroeconomics and Modalities" in V.,V. Ramanadham, Privatisation in Developing Countries. London: Rougledge.

Hannah, Leslie. 1979. Electricity Before Nationalization: A Study of the Development of the Electricity Supply Industry in Britain to 1948. Baltimore: Johns Hopkins.

Heald, David. 1989. "The United Kingdom: Privatisation in its Political Context" in John Vickers and Vincent Wright, eds., The Politics of Privatisation in Western Europe. London: Frank Cass.

Hirsh, Richard. 1989. Technology and Transformation in the American Electric Utility Industry. Cambridge: Cambridge University Press.

Hirshleifer, Jack; James De Haven; and Jerome Milliman. 1960. Water Supply: Economics, Technology, and Policy. Chicago: University of Chicago.

Helman, John and Gerald W. Johnson.1992. The Politics and Economics of Privatization: The Case of Wastewater Treatment. Tuscaloosa: The University of Alabama Press.

Holcombe, A.N. 1911. Public Ownership of Telephones on the Continent of Europe. Cambridge: Harvard University Press.

Hughes, Thomas Parke. 1983. Networks of Power: Electrification in Western Society, 1880-1930. Baltimore: Johns Hopkins.

Jacobson, Charles D. 1989. "Private Firms and Public Goods: Historical Perspectives on Contracting Out for Public Services," in Ann Durkin Keating Ed., Public Private Partnerships: Privatization in Historical Perspective. Chicago: Public Works Historical Society.

Jordan, Don. 1989. "The Hidden Threat," Public Utilities Fortnightly March 15 , 1991.
Keating, Ann Durkin, "Public-Private Partnerships in Public Works: A bibliographic Essay" in Public Private Partnerships: Privatization in Historical Perspective. Chicago: Public Works Historical Society.

Lorrain, Domanique. 1992. "The French Model of Urban Services" West European Politics Vol. 15, April.

Lovins, Amory B. 1977. Soft Energy Paths: Toward a Durable Peace. New York: Harper & Row.

Maclean, Mairi. 1991. French Enterprise and the Challenge of the British Water Industry Water Without Frontiers. Aldershot: Avebury.

Melosi, Martin V. 1981. Garbage in the Cities: Refuse, Reform, and the Environment, 1880-1980. College Station, Texas: Texas A & M University Press.

Meyer, John R. and Jose A. Gomez-Ibanez. 1981. Autos, Transit and Cities. Cambridge: Harvard University Press.

Mosher, William. 1929. Electrical Utilities: The Crisis in Public Control. New York: Harper & Brothers.

National Council on Public Works Improvement. 1988. Fragile Foundations: A Report on America's Public Works. Washington, D.C.: Government Printing Office, February.

Passer, Harold C. 1953. The Electrical Manufacturers. Cambridge: Harvard University Press.

Persaud, Bishnodat. 1992. "Foreward" in Adam, Christopher, William Cavendish, and Percy S. Mistry, Adjusting Privatization: Case Studies from Developing Countries. London: James Currey.

Peterson, Jon A. 1979. "The Impact of Sanitary Reform upon American Urban Planning," Journal of Social History. Vol 13, Fall.

Phillips, Charles. 1988. The Regulation of Public Utilities: Theory and Practice. Arlington: Public Utilities Reports.

Rosen, Christine Meisner. 1986. The Limits of Power: Great Fires and the Process of City Growth in America. New York: Cambridge University.

Roth, Gabrie. 1987. The Private Provision of Public Services in Developing Countries. New York: Oxford University Press.

Rozenzwig, Richard. 1993. "The Energy Policy Act of 1992" Public Utilities Fortnightly. January 1.

Scheiber, Harry. 1975. "Federalism and the American Economic Order, 1789-1910," Law and Society Review. Vol. 10, Fall.

Suggs, Robert E. 1989. Minorities and Privatization: Economic Mobility at Risk. Washington D.C.: Joint Center for Political Studies.

Sutcliffe, Anthony. 1981 Towards the Planned City: Germany, the United States and France 1780-1914. New York: St. Martin's.

Swidler, Joseph. 1991. "An Unthinkably Horrible Situation," Public Utilities Fortnightly. September 15.

Tarr, Joel A. 1984b. "The Evolution of the Urban Infrastructure in the Nineteenth and Twentieth Centuries," in Royce Hanson ed., Perspectives on Urban Infrastructure. (Washington, D.C.: National Academy Press.

Tarr, Joel A., James McCurley III, Francis C. McMichael, and Terry Yosie. 1984a. "Water and Wastes: A Retrospective Assessment of Wastewater Technology in the United States, 1800-1932," Technology and Culture. Vol. 25, April.

Twentieth Century Fund. 1948. Electric Power and Government Policy. New York: Twentieth Century Fund.

U.S. Congress, Congressional Budget Office. 1988. New Directions for the Nation's Public Works. Washington, D.C.: U.S. Government Printing Office.

U.S. Congress, Office of Technology Assessment. 1991. Delivering the Goods: Public Works Technologies, Management, and Financing. Washington, D.C.: U.S. Government Printing Office, April.

Vickers, John and Vincent Wright. 1989. "The Politics of Privatisation in Western Europe: An Overview" in John Vickers and Vincent Wright, eds., The Politics of Privatisation in Western Europe. London: Frank Cass.

Weiss, Marc A. 1987. The Rise of the Community Builders: The American Real Estate Industry and Urban Land Planning. New York: Columbia University Press.

Weiss, Marc A. and John W. Watts. 1989. "Community Builders and Community Associations: The Role of Large-Scale Developers in Private Residential Governance," Residential Community Associations in the Intergovernmental Systems. Washington, D.C.: U.S. Advisory Commission on Intergovernmental Relations.

Williamson, Oliver. 1985. The Economic Institutions of Capitalism. New York: The Free Press.

Wilcox, Delos. 1915. Report of Delos F. Wilcox, Deputy Commissioner in Relation to the Queens County Water Company. New York: Department of Water Supply, Gas, and Electricity.

Wittig, George. 1930. "Technological Developments" in Bureau of the Census, Census of Electrical Industries 1927: Central Electric Light and Power Stations. Washington D.C.: Government Printing Office.

Wohl, Martin. "From Private to Public Transit: Lessons From Our 100-Year Experience in America." Cambridge, Massachusetts: U.S. Dept. of Transportation, SS-243-U.3-210.

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